

## **REMARKS**

This AMENDMENT UNDER 37 CFR 1.111 is filed in reply to the outstanding Office Action of July 14, 2004, and is believed to be fully responsive thereto for reasons set forth below in greater detail.

Responsive to the objection to the specification, paragraph [0005] has been amended as suggested kindly by the Examiner.

Reconsideration is respectfully requested of the rejection of:

claims 1, 4, 5 and 7 under 35 U.S.C. 102(b) as being allegedly anticipated by Suwanai et al. (U.S. 5,994,762);

claims 2 and 3 under 35 U.S.C. 103(a) as being unpatentable over Suwanai in view of Ma et al. (U.S. 6,509,622); and

claim 6 under 35 U.S.C. 103(a) as being unpatentable over Suwanai in view of Mulligan et al. (U.S. 2003/0100143 A1).

Initially, independent claims 1 and 7 have been amended to more distinctly point out the novelty of the present invention.

The present invention provides a crack stop for low K dielectric materials of an integrated circuit (IC) including metal layers separated by capping layers, a top aluminum layer, and copper or silver metal interconnects which do not form a self-passivating oxide layer, in a low-K dielectric material to prevent damage to the active area of the IC chip caused by chipping and cracking formed along peripheral edges of the IC chip during a dicing operation. A moisture barrier or edge seal is formed as a metal stack positioned along the outer peripheral edges of the active area of the IC chip. The crack stop is formed by at least one trench or groove positioned

outside of the moisture barrier/edge seal on the outer periphery of the IC chip.

This construction is quite different from the primary reference Suwani et al. One significant difference is that in Suwani the metal interconnects of the Y select line YS and the wiring 21 are disclosed as being tungsten (W), column 8, lines 39-40, and the metal interconnects of the shunting word line SWL and the wiring 24 are constituted of a three layered conductive film comprising a lamination of a titanium tungsten (TiW) film, an Al film, and another TiW film, column 8, lines 53-56. These metal interconnects form a self-passivating oxide layer.

The present specification explains the following at page 2, paragraphs [0006] and [0007].

“In prior art aluminum Al interconnect technology, wherein Al forms a self-passivating oxide layer, the crack stop has been formed as either a metal stack or an etched-out region that surrounds the active circuit area of the chip, and prevents cracks from traversing the BEOL dielectrics into the IC chip.

In prior art copper Cu interconnect technology (which does not form a self-passivating oxide layer), the crack stop has been formed as a metal stack that surrounds the active circuit area of the chip to prevent the propagation of cracks from traversing the BEOL dielectrics into the IC chip.”

Claims 1 and 11 now specify that the IC chip includes metal layers separated by capping layers, a top aluminum layer, and copper or silver metal interconnects which do not form a self-passivating oxide layer, in a low-K dielectric material.

In the present invention, the top aluminum layer and copper or silver interconnects form a synergistic combination that allow the moisture barrier/edge seal 12 and the crack stop 28

to be formed simultaneously by a wet etch using the aluminum layer as an etch mask, which also self-aligns the moisture barrier/edge seal and the crack stop.

In contrast thereto, Suwani requires an additional mask to form both the guard ring and the crack stop, and moreover the guard ring and the crack stop are not self-aligned because of the additional required mask.

Accordingly, independent claims 1 and 6 distinguish over Suwani by specifying that the IC chip includes metal layers separated by capping layers, a top aluminum layer, and copper or silver metal interconnects which do not form a self-passivating oxide layer, in a low-K dielectric material.

The secondary reference of Ma et al merely discloses metal interconnects which are acknowledged to be old, and the secondary reference of Mulligan et al merely discloses two trenches on both sides of each dicing street. Neither Ma et al nor Mulligan et al compensate for the deficiencies of the primary reference Suwani as noted above.

This application is now believed to be in condition for allowance, a Notice of Allowance is respectfully requested. If the Examiner believes a telephone conference might expedite prosecution of this case, it is respectfully requested that he call applicant's attorney at (516) 742-4343.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "William C. Roch". The signature is fluid and cursive, with the first name "William" and last name "Roch" clearly distinguishable.

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